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Ecology in Science Teaching*

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When defined, ecology may be broad and with many ramifications, or narrow and confined to biology alone. The present proposal is to make it broad enough in scope to include:

1. Life habitats and their distribution
2. Living versus physical phenomena
3. Community development, from the pioneer to mature stages of plant, animal and human communities
4. Interdependence of life within communities
5. Conservation of resources, both natural and human

From the standpoint of subject matter, science makes the greatest contribution to ecology instruction. Biology, as the science of life, would naturally make the most outstanding contribution of the sciences. Chemistry and Physics in their analyses of chemical processes in nature, study of physical environment and its application to everyday living, and conservation of natural resources through production of synthetic products and "stretchers" for natural products, rank close to Biology in ecological importance. Agriculture in its knowledge of soils and soil use, plant and animal structure and physiology, and the development of plant-animal communities, makes a direct contribution to ecology teaching.

Social science through its study of economics, social problems and history of various regions, and English in its survey of national, regional and state literature offer a vast fund of knowledge to ecology instruction, particularly in the realm of human ecology. Home Economics, Health and Physical Education, through their conservation of human resources, integrate with the sciences. In fact, Home Economics, like Agriculture, approaches the study of food production from a direct ecological viewpoint.

Functional life areas, as well as subject matter areas, contribute to ecology instruction. Outstanding among these are *Food and Nutrition, Health, Reproduction and Human Improvement, Heredity*

* Presented at Boston before THE NATIONAL ASSOCIATION OF BIOLOGY TEACHERS, December 29, 1946.

and Racial Betterment, Conservation of Resources, Economic Plant and Animal Products, Avocational Studies in the Out-of-doors, and Vocational Interests, particularly in the science fields.

By way of illustration three of these life areas may be enlarged to show their ecological scope.

I. Food and Nutrition

1. Soils (types and location)
2. Land use (farming, pasturing, lumbering, building, etc.)
3. Relation of soils to health
   a. Nutritious soils→healthy plants→healthy animals
   b. Deficient soils→deficient plants→unhealthy animals and humans
4. Agricultural regions
   a. National
   b. State
   c. Local, including
      (1) Flow chart of food products
      (2) Modes of distributing food
      (3) Methods of preserving food
5. Diets
   a. Adequate, balanced diets
   b. Not adequate, unbalanced diets
      (1) Reasons
      (2) Areas most prominent
      (3) Effects upon human bodies, both now and in future

II. Conservation of Natural Resources

1. Distribution of living organisms
   a. Areas of living organisms
   b. Methods of distribution
   c. Barriers to distribution
   d. Differences as response to environment
2. Development of plant-animal communities
   a. Succession from pioneer communities to mature or climax communities
   b. Interdependence within communities
      (1) Plant with plant
      (2) Animal with animal
      (3) Plant with animal
3. Relation of human community to plant-animal community
   a. Natural balance of plants and animals
   b. Disturbance of balance by man
      (1) Soil erosion
      (2) Depletion of soil minerals
      (3) Deforestation
      (4) Water pollution
      (5) Destruction of wildlife
      (6) Waste of coal, oil, etc.
   c. Restoration of balance by man (conservation)
      (1) Agencies in conservation
         (a) National
         (b) State
         (c) Local
      (2) Projects in conservation
         (a) Soil conservation projects
         (b) National, state and county forests
         (c) National, state and local parks
         (d) Wildlife preserves and sanctuaries
         (e) Stream clearance and waste disposal plants
         (f) Proper and wise use of minerals, coal and oil

III. Economic Plant and Animal Products

1. Food plants and animals
   a. Origin
   b. Distribution and adaptation
   c. Variety of uses
2. Plants and animals for industry
   a. Building materials
   b. Fuels
   c. Fibers
   d. Rubber
   e. Oils
   f. Synthetics (fibers, rubber and plastics)
3. Medicinal plants and animals
   a. Origin
   b. Wild and cultivated or domesticated
   c. Parts useful in medication
   d. Medicinal uses
   e. Anti-biotics from natural and synthetic products
      (1) Sulfa drugs
      (2) Penicillin
      (3) Streptomycin, etc.

A large variety of projects in the out-of-doors and in the laboratory, as well as films, reports, testing devices, student

discussions and outside speakers may be used to develop these functional areas. A course in Biology offers one of the most suitable places in the curriculum for the development of such ecological instruction, but as indicated earlier, other subject matter areas contribute to and integrate with the biological subject matter.

Wherever taught, there are certain ecological principles to keep foremost in the minds of students:

1. From plant-animal communities come natural resources.
2. Communities are ever changing as a result of natural or man-made successions.
3. Natural resources must be converted into usable resources on farms, in industries and in laboratories, without destroying their sources.
4. For limited or lacking resources, substitutes must be found.
5. A knowledge of community development, and the interdependence of life therein, is necessary for the farmer, forester, engineer, and city planner.
6. The youth of today will be the farmers, foresters, engineers and city planners of tomorrow.
7. The above offers an ecological approach to a way of living.

A School Conservation Project*

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The property originally purchased by the Cuyahoga Heights Board of Education consisted of a rather narrow, quite level strip of land, on which was constructed the building and elementary playground, and a rough area containing two very large gullies. The athletic grounds were formed by cutting off enough dirt from the top of one hill and side of another to fill one of the large gullies. The athletic field is about 25 feet below the basement level of the school. The filling of this large gully left a bare, clayey slope about 75 yards long at the top and approximately 50 yards from top to bottom. A similar situation, though much smaller, was created at the head of the other gully where the ground was leveled to make a turning area for the school busses and a driveway down to the athletic field. No steps were taken to control the erosion of these bare slopes.

By the end of the third year, the author's first year at Cuyahoga Heights, erosion was quite far along and was beginning to cut back into the level field (Figure 1). This problem was discussed with the superintendent as a conservation project in connection with the author's classes. The author planned the program and the needed materials were purchased by the Board of Education.

Figure 1. Bare hillside in the spring of 1942.

* The first part of this article, to addenda, page 235, is reprinted, with minor changes, from the December, 1946, issue of Science Education.

Figure 2. Biology class planting trees.

In the spring of 1942 this problem was introduced in the biology and nature study classes as a part of a unit on conservation. The greenhouse class studied some of the problems of different soils and plants that would grow on the different soils.

The general topics discussed at varying levels in all the classes were:

1. Erosion and causes of erosion.
2. Causes of rapid run off and how it may be controlled.
3. Types of soils and plants that will grow well on the different soils.
4. Various trees, shrubs, and herbaceous plants that are used for erosion control and the reasons for their use.
5. The selection of the trees to transplant, proper spacing, and how to give them a good start.
6. Organization to get the most done in the time available.

The trees selected were one-year-old Black Locust seedlings. Black Locusts grow rapidly and do well under most conditions. To give the trees a good start in the acid clay soil a fair-sized hole was dug for each tree, a small trowel of lime was placed in the bottom of the hole and covered with a shovel of top soil, the tree was set in, and the original clay soil was used to fill the hole. The dirt was packed and an oval-shaped depression was left around each tree to catch extra moisture. These trees were spaced approximately eight feet apart in horizontal rows which were also eight feet apart. However, the rows were staggered giving the appearance of vertical rows 4 feet apart. This was to break up the space between the vertical rows to more quickly produce some run-off control.

In the larger classes two of the more reliable pupils were given the responsibility of laying out the rows. These pupils used a pole, marked at eight feet (Figure 2), to determine the place for the tree and then drove a stake at the proper place. Another group dug the holes, another put in the lime, another brought the top soil, another distributed the trees, and another group planted the trees. All the groups except the pupils marking the places for transplanting were allowed to change jobs. In this way considerable work was accomplished in one or two periods.

Later a few tons of straw were scattered along a rather narrow strip at the top of the slope and in the largest eroded ditches, and then inoculated lespedeza seed was sown broadcast. The straw was to check run-off near the top and to help grass and lespedeza to get started and spread down the hill. The lespedeza stand was poor, but at the present time grass and weeds have spread so that most of the hill is covered with a dense growth of vegetation.

The top soil was piled in three piles at the top of the hill, which saved much walking as it had to be carried down the hill to the needed places. The bales of straw were also distributed along the top of the hill.

At that time, the biology classes were scheduled to meet for two consecutive forty-five-minute periods two days each week. On the days the biology classes

had double periods all pupils in the biology and seventh nature study classes came to school wearing their old shoes and older school clothes. These pupils reported directly to the greenhouse for instructions and then as a group to the project. This saved considerable time and confusion.

This work was done as a project by the greenhouse, biology, and seventh grade nature study classes during their class periods in one or two periods a week. During this period of about four to six weeks in the spring of 1942 these classes transplanted about eight hundred trees. A few trees died, due chiefly to rabbit injury.

Very little work was accomplished the following spring because of frequent rains and muddy conditions. Since that time no more work has been done on this project because the author's time has been devoted to the physical sciences and coaching.

In the spring of 1946, after four seasons of growth, the trees were about twelve feet tall and beginning to crowd (Figure 3). A dense growth of grass and weeds had covered the hillside except in a few places. A major part of the erosion had been stopped and the top part of the hill had stopped slipping.

This project was started as a means to study causes of and methods to control erosion. However, this and other waste land owned by the Board of Education could be slowly converted into a school forest by a similar method to provide a variety of trees, shrubs, and flowers to be used as a natural source of materials for nature study.

Figure 3. Same hillside after four seasons of growth, spring of 1946.

Addenda

In answer to questions raised by readers of the above report the following information has been added to explain briefly the nature of the greenhouse and biology program at Cuyahoga Heights High School.

The Cuyahoga Heights Local School District is made up of three small villages, Cuyahoga Heights, Brooklyn Heights, and Valley View, all suburbs of the city of Cleveland. The inhabitants of these villages are largely laborers, skilled workers, and vegetable growers with some executive, professional and small business men. The village of Brooklyn Heights has numerous vegetable forms and greenhouses with approximately 39 acres under glass. With these varied interests the Board of Education included not only well-equipped class rooms for the regular high school courses, but also a machine shop, foundry, electrical shop, and a greenhouse in its building program.

The school is not large, the total enrollment from kindergarten through the twelfth grade being approximately five hundred pupils. The classes in general are small. At the time the author carried out the above project there were about thirty students in biology in two sections, about forty pupils in seventh grade nature study, and eight students in the greenhouse class.

Biology is a required course in the school curriculum and is usually taken during the sophomore year. Topics in biology, as study of insects and elemen-

tary plant structure and physiology, are of considerable importance and are reviewed informally by greenhouse pupils.

The greenhouse classes are open to juniors and seniors who are interested in this work. Most of these students are interested in commercial greenhouse vegetable growing or flower growing and making floral arrangements.

The greenhouse supplies plants, seed, and soil for biology, nature study, and elementary science classes when desired, and prepares the seed packets and starts the plants, as tomatoes, for the school garden program. Space is also provided for the greenhouse students to start vegetable and flower plants for their own summer gardens if they wish.

The school greenhouse, 44 feet by 76 feet, consists of two even-span houses, each 22 feet by 76 feet, with a glass partition between the two houses. It is divided into five rooms, each with separate heating and ventilation. This arrangement makes it possible to grow a wide variety of plants. The temperature in the so-called "warm room" is usually held at 60° Fahrenheit night temperature. It is used chiefly for growing roses, gardenias, and other warm-house plants. Plants such as carnations, snapdragons, and chrysanthemums are grown in the cold room, which usually has a night temperature of 50° Fahrenheit. Soil mixing, potting, and similar work is done in the work room. Also, many of the potted plants, as Cineraria, are grown in this room. The hydroponics room is equipped for gravel culture. Some chrysanthemums are grown in the summer and fall, usually being replaced by tomatoes for the winter and spring. The largest room is the vegetable room. It is chiefly devoted to tomato production. Crops of lettuce and radishes are often used as a late spring crop.

The greenhouse class is conducted almost entirely on a pupil activity basis. Nearly all the work is done by the pupils in the two periods scheduled for this class except the necessary care over weekends and during vacations. For example, a plot of ground for tomatoes is assigned to a boy. He cares for the crop from seed planting till the vines are pulled and keeps a complete record of this crop. A crop of stocks is assigned to a girl. She has complete charge of this crop from seed planting to cutting. After the crop is completed the pupil writes a condensed report which is filed under the heading for this particular crop.

Many problems arise from such an assignment. Such problems include the method of planting the seed, how to control "damping off," how far apart to bench the plants, the proper amounts of fertilizer, and the control of various insects. The pupils learn to handle these problems through the use of various reference books, magazines, pamphlets, and suggestions from the instructor. In addition to informal discussions and individual questioning by the instructor, pupils write out answers to various basic questions regarding plants, fertilizers, soil conditions, and insect control. These lists of questions are usually posted on the bulletin board.

There are numerous related activities in addition to those mentioned. Interested students learn to make soil analyses for available minerals and pH and to make recommendations. Some learn to make small floral pieces and corsages. Also fertilizer deficiency studies are carried on with tomatoes, using a different fertilizer solution for each of the twelve small hydroponic boxes.

Since this greenhouse program is quite extensive and varied it would not be practical for most schools. However, in most schools a small greenhouse would be a useful addition to the biology or agricultural department.

The Biology Department and Community Service*

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One of the positive approaches to the betterment of our schools and subsequently our positions in the schools is to demonstrate what we can do in the way of community service. The purpose of this discussion is to illustrate some specific services to the community that can be rendered by the department of biological sciences. This is notwithstanding the fact that we recognize and believe that education itself in the support and preservation of free men is ample justification to the community for the schools in general, and for our field in particular. On the other hand, it may help us for the community to feel that they are getting a little something extra. To be perfectly frank about it, is not that what the music departments, the drama departments, and the athletic departments are doing in the public's mind? They bring the community to the school. Let us let the community see what we are doing also.

The idea of the biology department and community service first suggested itself to us a number of years ago while we were doing undergraduate work with Professor R. G. Upton, Stephen F. Austin State Teachers College, who was at that time conducting a survey of the school children in several East Texas counties to determine the amount of hookworm infestation. In sixteen rural schools included during one year of this survey, more than 48% of the children were reported positive. A similar type of survey would not be out of reach of an enterprising biology teacher working in an area where this parasite is prevalent. Of course, it raises the question of time for such a project by the teacher. There is not an available solution that is too satisfactory for this problem now; however, two ideas can be suggested. First, this is as good a time as any for us to suggest to school administrators and school boards that science teachers should be freed for science work and that there is plenty of community service in the field of science without adding a lot of other services to the science teacher's load. The second suggestion is for the biology teacher to make use of available help in projects of this type from local and state health departments, colleges and universities, and various organizations concerned with the development of studies of this type.

During the past five years, the Raymond L. Ditmars Scientific Society, with the cooperation of other science clubs and the local health department, has sponsored a Tuberculin Testing Campaign for students in the Austin High School. This program was developed largely through the efforts of Mathis Blackstock, a student; Mr. Sigman Hayes, former head of the Biological Science Department; and Miss Helen Boysen and Dr. Mary Edwards, teachers in the Department. The Campaign is usually conducted in the spring of each year and begins with the setting up of displays and bulletin boards designed to show the importance of early diagnosis in tubercular cases. This is followed by an assembly program which features a movie

* Presented before THE TEXAS ASSOCIATION OF SCIENCE TEACHERS, Houston, Texas, November 29, 1946.

on tuberculosis and perhaps a talk by a local health department doctor. A mimeographed description of the tuberculin test and its use in subsequent diagnosis is given to each student with the request that he show it to his parents and ask them to sign a note giving him permission to take the tuberculin test. On given days the students who have this permission from their parents are sent to an assigned room at their advisory period. Here a doctor and/or nurses from the local health department administer the test. The students report back on the third day at the same period to have a reading by the health department officials. Members of the science clubs and faculty assist in this part of the campaign by directing the students when and where to report for the tests, and recording the required data for each test. Members of the health department interview each positive tuberculin test case individually, and the student is advised not to be unduly alarmed but to go to the family doctor for chest x-rays and further diagnosis. For students with a positive tuberculin test who are not able to afford an x-ray, special arrangements are made with three local doctors to take the pictures at a considerably reduced price. The following table shows the available data compiled on the Tuberculin Testing Program since the beginning of the Campaign.

Of course it is obvious that only a very small per cent of these positive tuberculin test cases actually have active tuberculosis. The values of the testing campaign from the community service point of view are: (1) directing possible positive cases to the doctor for observation; and (2) community education for constant war against the disease which is one of the leading causes of death from ages twenty to forty.

According to data from the Texas State Health Department there were thirteen cases of typhus fever in six counties of the State in 1930. In 1944 there were 1740 cases in 137 counties. One of the approaches to the prevention of further spread of this disease is to develop effective rodent control. Rodent control is not only helpful in the prevention of typhus and other diseases but also very useful in preventing the destruction by rats of large quantities of valuable property. But what can your biological science department do in this type of community service? In 1943 the department at Austin High attempted to

DATA FROM TUBERCULIN TESTING PROGRAM
AUSTIN HIGH SCHOOL
1941–1946

SCHOOL YEAR	Number Tested			Number Positive			Percent Positive		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
1941–42	574	566	1140	114	88	202	19.8	15.5	17.8
1942–43	156	168	324	24	19	43	15.3	11.3	13.3
1943–44	137	173	310	31	26	57	22.6	15.0	18.3
1944–45	225	252	477	17	10	27	7.6	3.9	5.6
1945–46			470			39			8.3
TOTALS			2711			368			13.5

do its bit in this way. We went to Miss Bertha Casey, an English teacher, and suggested that we could look up some reference material if some of her students in creative writing would be interested in writing an original one-act play on rodent control. This they did, and we selected one of the best and called upon our drama teacher, Miss Robbie Wells. She selected a cast and produced the play. It was first used for an assembly program in the high school and later was presented at an Austin Junior Academy of Science program, at a Junior Chamber of Commerce program in Marlin, and at various civic clubs in Austin and in San Antonio. Copies of the play were mimeographed by the State Health Department for use in various parts of the State. The play was adapted for radio, and was broadcast over stations in San Antonio and Austin. This fall the play was revived and re-broadcast by students in the current radio speech class of Miss Naomi Davis. The following is a transcription of the play as broadcast.

OH, RATS!

A Play in One Act

by

SUZANNE CATLETT

Cast

One announcer
One adult male voice
One adult female voice
One male child's voice (about seven years old)
One female child's voice (about twelve years old)

Sound Effects

Door slamming, door closing, book slamming, sound of dishes, paper rustling

ANNOUNCER: Suzanne Catlett, a high school student of Austin, Texas, has written a very clever little 15-minute play which we believe you will enjoy. It deals with rodent control and its relation to typhus fever, and she has appropriately entitled her play, *Oh, Rats!*

As the scene opens in the combination living-dinning room of the Timothy home, we find Josie Timothy absorbed in a book almost as big as she is. Josie after all is a small girl with long braids of hair and horn-rimmed glasses and presenting a very studious appearance. Josie's little brother Junior Timothy is equally absorbed in a small model airplane which he is making every effort to fly about the room. He is a considerable worry to serious-minded little Josie, who in addition to the big volume in her right hand, is holding in her left four formidable-looking rat traps. Josie is reading aloud:

JOSIE: (Reading) "Trapping is a good means of eliminating rats if enough traps are used."

"Traps should be placed in the known runway of rats—along walls, on top of beams, and in the rat's path. Use with or without bait. Tie the trap securely so that the rat cannot escape with it. Select bait carefully for freshness."

Well, I guess I'm almost through. This makes the twelfth trap—one by the garbage, six in the basement, and the others in cupboards and runways. Let's see—where else should I go if I were a rat? Oh, yes, I'll put one here by these books and this chair and two others—(pauses) let's see—against the walls. Then I guess I'd better put this fourth trap in the drawer of the table. Might be a rat get in there.

JUNIOR: Buzzzzzzzzzz—
JOSIE: Junior, you know what I'm doing?
JUNIOR: Buzzzzzzzzzz—nope.
JOSIE: (Proudly) I'm exterminating.
JUNIOR: Huh?
JOSIE: (Reverently) I'm exterminating a *great destructive enemy of mankind.*
JUNIOR: Japs?
JOSIE: (Disgusted) No, Junior, rats.
JUNIOR: (Disappointed; goes back to flying plane) Oh. Buzzzzzzzzzz—
JOSIE: (Fervently) I'm saving humanity!
JUNIOR: Ha! Buzzzzzzzzzz—
JOSIE: Oh, you *pinhead!* If you ever enlightened your outlook and read such a volume as Kunkledorf, Dobblestein, and O'Reilly's perfectly marvelous book on Rat Control, you wouldn't scoff!
JUNIOR: Nuts! Buzzzzzzzzzz—(Fade under)
JOSIE: Come here, Junior. I want to feel your forehead. (Dramatically) Junior, I think your temperature is rising! Do you have rheumatic pains? Do you have a headache? Junior, do you have a slight rigor of the muscles?
JUNIOR: (Wondering; stops plane) Huh? Naw. Certainly not!
JOSIE: Those are the main symptoms of typhus. I think you've got it!
JUNIOR: (Awed) I have? Gee! What's that? What have I got?
JOSIE: Oh, Junior, I've just got to lend you Kunkledorf, Dobblestein and O'Reilly. It's a disease, a fever. Here, I've got it right here—on page 72. "Typhus fever is a disease transmitted to man by the rat flea. The flea is infected through the rat and carries the disease to man. Rats rarely die of typhus, so are able, even though infected, to travel great distances, thus spreading the disease. The disease is most prevalent in summer and fall. In 1943, 1,452 people in the State of Texas were reported infected with typhus fever."
JUNIOR: Buzzzzzzzzzz—
JOSIE: (Angrily) Why, Junior Timothy! You haven't heard a word I've said. You—you—pinhead!
SOUND: Book slammed shut.
MRS. T.: Ahhhhh. This sack of groceries really got heavy. Hello, Josie; Junior.
JOSIE: Hello, Mother!
JUNIOR: Hi, Mother.
JOSIE: Maybe you have rigor of the muscles.
MRS. T.: Josie, what are you staring like that for?
JOSIE: Mother, do you feel all right?
MRS. T.: Why, I suppose so. I'm a little tired—
JOSIE: You haven't got a headache, or any temperature, or rigor of the muscles, or anything?
MRS. T.: What's that?
JUNIOR: Buzzzzzzzzzz. She thinks you're infected with rats.
SOUND: Rattling of sack.
JOSIE: Let me see what's in the sack. (Disappointedly) Awwwwwww—What he means, Mother is that I am trying to protect my home and family from a great destructive menace to our health.
JUNIOR: Yeah, that's what I mean.
MRS. T.: My Goodness!
JOSIE: I had to study rats and typhus control for a report in hygiene in school, and I have decided to make that the theme of my term thesis, and perhaps my life work. I am taking steps to control this serious problem in our own home. Who knows? We may all get typhus fever. If everyone would take precautionary measures, this great problem would eventually be solved. (Ends dramatically, then whines) Mother, didn't you get any cheese?
MRS. T.: No, dear. That's a fine idea, Josie, but there are no rats in this house. *Nice* people don't have rats.
JOSIE: Oh, yes, they do, Mother. You wouldn't call the White House bad, and it has had to be ratproofed because a rat ran across the porch while Mrs. Roosevelt was entertaining guests. You have never seen one, but Kunkledorf, Dobblestein, and O'Reilly say that in many cases occupants of a house are not aware of the presence of rats, but they are there just the same. Rats like comfortable, warm houses as well as human beings, but they stay hidden in attics, basements, and between walls.
MRS. T.: Really! (Nervously) Well, of course, I am in favor of taking any steps necessary to protect us from rats and typhus fever, but I hate to see you start another one of your campaigns. You worked yourself sick killing the ants in the yard last year.
JOSIE: (Proudly) Well, I did it, didn't I? And this is necessary!
MRS. T.: (Wearily) Well, be careful, dear. Here, let me put my purse in the drawer. (Hand get caught in trap. Yells loudly) Josie, Josie!
JOSIE: Oh, Mother—I'm terribly sorry, Mother. I guess I forgot to tell you—ah—that—that trap was for a rat.
JUNIOR: (Laughs loudly) Poor Mother! Ha ha ha—poor Mother.
JOSIE: Is it all right now? Look at that bruise. (Dreamily) Think what that could do to a rat! Does it hurt much?
MRS. T.: Only bruised, but it's painful. Here, come with me and carry the groceries. You have to set the table.
JOSIE: (Meekly) Yes, ma'm. (Fading) I'll go get the dishes.
SOUND: Door opens (Enter Mr. Timothy)
JUNIOR: Hi, Dad.

JOSIE: Hello, Father.

MRS. T.: (Fades in) This roast *looks* good. Well, hello, George; you're a little late. Supper's almost ready. How'd it go today?

MR. T.: Fine, fine, Alice. I came home with Cy Turner; he's a card! Boy, this rocking chair looks good to me. I'm sure tired. Well, how're the kiddies?

JOSIE: I do wish you'd refrain from "kiddying" me, Father. I'm grappling with adult problems.

JUNIOR: I think Mother's the one that grappled.

JOSIE: (Sarcastically) *Clever* boy. Father, how can you have one child so smart and one so dumb?

JUNIOR: Oh, buck up, Josie, you're not so dumb.

JOSIE: (Angrily) You're impossible!

MR. T.: Children, children.

JOSIE: Father, let me feel your forehead.

MR. T.: What's the matter, Josie?

JOSIE: Oh, nothing. (Pause) Father, do you know anything about typhus?

MR. T.: Why, yes, that's a—uh—a—uh—

JOSIE: (Interrupting) a disease. A disease spread by rats, a very wide-spread disease, especially here in Texas.

MR. T.: Of course, that's what I was about to say, a disease. Let's see what's news today.

SOUND: Rustling of newspaper.

JUNIOR: Mother, when do we eat?

MRS. T.: (Fading in) Right now; come on to the table. Mind your napkin, Junior.

JUNIOR: Mmmmmmmmm-look at that roast. Yes'm Mother.

JOSIE: A rat would *love* this meal.

JUNIOR: What a lovely thought.

JOSIE: Rats love carrots, tomatoes, and meat. They are good for bait—also—wait a moment let me read it—"bacon, fish, apples, and doughnuts, etc."

MRS. T.: Really, Josie, can't you speak more pleasantly at the table?

JOSIE: But, Mother—

MRS. T.: What happened to you today, George?

MR. T.: I rode home with Cy Turner this afternoon. He's really a card! You know what he did?

JOSIE: Goodness! They have eight rats per litter, five times a year—that's forty.

MR. T.: (Flustered) Cy has eight rats per—Oh, no! I mean—Cy Turner is really a card!

MRS. T.: You said that, dear. What did he do? Junior, stop gulping your food.

JOSIE: A cat'll gulp down a rat in a second. Daddy why don't we get a cat?

MR. T.: Because I hate cats. Well, Alice—we got on the bus and—

JOSIE: And they destroy $20.00 worth of food, dry goods, and supplies a year—apiece!

MR. T.: (Sternly) I'm talking, Josie—Well, Alice, we got on this bus, see, these busses are awful, so crowded—

JOSIE: They are the greatest enemy of domestic poultry.

MR. T.: Busses?

JOSIE: No. rats. Who said anything about busses?

MR. T.: I did. Cy Turner and I got on this crowded bus, and Cy says—

JOSIE: Is our garbage can closed up?

MRS. T.: Yes, dear, I think so.

JUNIOR: Go on, Dad.

MR. T.: Yes, well,—Cy says—

JOSIE: That's good, because they say the open garbage can is one of the most common forms of food for the rat, and is the first thing that should be corrected in rodent control.

MR. T.: Josie, I'm talking.

JOSIE: I'm sorry, Father.

JUNIOR: Go ahead.

MR. T.: Well, Cy says to me—

JOSIE: Is everybody through? I'm through. I've got to see about that garbage can.

MRS. T.: You haven't time, dear—your club meeting.

JOSIE: Oh, yes. I've got to hurry. (Fading out) Excuse me.

JUNIOR: Now tell us, Dad.

MRS. T.: I'll be stacking the dishes.

JOSIE: (Fading in) I'm leaving, but where is my Kunkeldorf, Dobblestein, and O'-Reilly?

JUNIOR: Here. Can't you live without that thing?

JOSIE: (Proudly) I'm going to make a speech tonight!

MRS. T.: Hurry on, dear. Junior, get to studying. (He groans.)

JOSIE: Goodbye (pauses) Junior, I'll leave this if you wanna look it over. I know it all anyway.

JUNIOR: No, thanks! *GOODBYE!* (mumbles) Oh, well, I'll get my books. I think I put them here by the chair. (Yells out) Ouch! My hand's in a rat trap!

MRS. T.: Now, now, Junior. I know it hurts dreadfully, but it will stop in a few minutes. George, I'm so worried about Josie; let's get her a permanent, or some new dresses. This condition is alarming; traps;—Kunkleflopper; rats!

Junior, is it better now? Go on with your lessons.

Now, dear what was it you were saying about Cy Turner?

MR. T.: Oh, yes. Well, Cy and I go on this bus, and he—uh—(pauses), Alice, are you sure the top is on that garbage can? I'd better go see. (Fading out) We *should* be careful—

MRS. T.: (Resignedly) Oh, well. (Door slams violently) Why, Josie, what are you

doing home so soon?

JOSIE: Mother—

JUNIOR: I can hardly wait to get my one remaining hand around your throat.

JOSIE: (A little frightened) Now, Junior, don't be mad. I'm sorry, but you should have looked. I promise to use poison from now on. Poison is more effective, anyway. Mother, I'm going to resign from my club!

MRS. T.: (Amazed) But *why*, dear?

JOSIE: You know what they want to do? They want to have a *dance*. A dance in times like these—when a great menace threatens. Rats all over the country! Their spreading typhus fever endangers all of us—war workers, and soldiers—at times like these, when we should be working on *rat* control, they want to have a *dance*.

MRS. T.: Oh, well, don't feel so badly, dear.

MR. T.: (Excitedly) Hey, Alice, Josie, Junior—look!—the trap does get results—what a rat! The trap by the garbage can really caught a big one.

JOSIE AND MRS. T.: (Simultaneously) Oooh! A rat! (Sounds of confusion, jumping to chairs, bumping into table, etc.)

Opportunities for community service are not confined to making studies, surveys, and conducting campaigns. There are many within the school curriculum itself. Before the war the teachers in the Biological Science Department at Austin High decided students of biology and physiology should have training in first aid. Several of the teachers then took standard and instructor's first aid courses offered by the American Red Cross and qualified as first aid instructors. An accredited junior first aid course was then given as a part of the course of study in biology and physiology. In this way hundreds of citizens of the community who might otherwise not have had first aid training have had this opportunity.

During the war when so much stress was placed on health and fitness, we attempted to set up an entirely new course in the curriculum. The first semester started with a study of the agents which cause disease. Then methods of transmission of communicable diseases were studied. The greatest emphasis in the course was placed on general methods of control of communicable diseases. These included:

1. Early diagnosis
2. Quarantine and isolation.
3. Disinfection.
4. Search for and control of carriers and missed cases.
5. Immunization and chemotherapy.
6. Body defenses against disease.
7. Antiseptic hygiene and cleanliness.
8. Control of secondary vehicles of transmission—sewage disposal, water purification, milk sanitation and control, food establishment inspections, rodent control, and insect control.

The course also covered some study of the characteristics of specific communicable diseases; and although Austin is not primarily an industrial center, it included a brief unit on industrial health hazards. The first semester ended with a study of first aid.

The second semester of this course was offered by the Department of Home Economics and dealt with foods and nutrition, and home nursing. The course met with at least initial success and was well received by the students who took it.

In the development of such a course, one should keep in mind two factors that are necessary to its ultimate success. First, it must have the enthusiastic active support of the school administration; and, second, it must be recognized by our colleges and universities as entrance credit.

All of this might seem to indicate that community service from the Biological Science Department is limited to matters pertaining to health. Such, however, is not the complete story. We have many opportunities to stress conservation of our natural resources and all its implications. We can teach the why for game laws and to help to develop respect for them. Most rural schools have their agricultural teachers who

render a great deal of community service, but many city schools do not have this type of service. Perhaps we need to include in our biology courses in the city schools a little more about building lawns, care of trees and shrubs, pot plants and flower gardens, and plant parasites.

Besides conducting useful studies, survey, and campaigns and providing for community service within the curriculum, there is still another procedure that should not be overlooked. This can be promoted in the work of various science clubs and with special projects developed by members in such organizations. For example, in 1942 and 1943, the Raymond L. Ditmars Scientific Society at Austin High undertook the project of trapping rats in the high school building. Various individual projects by members of this club and other have pointed out publicly the usefulness of snakes as opposed to the harm a few cause. A few years ago one of our students who lived in a rural community near Austin undertook to run a bacterial analysis of the drinking water from seventeen wells in her community. She found four wells were positive for *E. coli* which indicates the possibility of typhoid contamination. Another student made a bacterial analysis of the water from the drinking fountains in the high school building and offered suggestions for the replacement of some with more approved types. Another student developed a project on "Landscaping Your Home with Native Shrubs and Wildflowers." Other projects and studies developed by students which may have contributed to the community include:

1. Patent Medicines That Enter the Home—Via Newspapers, Magazines, and Radio.
2. A Study of the Marihuana Plant and Its Effect in Texas.
3. The Mosquito—Public Enemy No. 1.
4. A Working Model of the Austin Waterworks.
5. An Investigation of the Sources and Uses of Milk in Austin.
6. Writing a Science Column in the High School Newspaper.
7. Chemical Analysis of Soil in My Victory Garden.

This list could be extended. It is difficult to say just how much value the community receives when some of its citizens develop studies and projects on problems such as these and are given opportunities to present them publicly at Junior Academy of Science and other meetings. At least it helps to indicate the importance of science in the community today.

SPRING MEETING

The Central Indiana Association of Biology Teachers held its spring meeting at Turkey Run State Park, Saturday, April 19, 1947. The following program was presented:

Business Meeting.

Plant field trip—Dr. J. E. Potager, Butler University.

"Using Our Indiana in Biology Teaching." Mr. Verne Sparks, Department of Conservation.

"Insect Life for Feld Work in Indiana." Mr. Frank Wallace, State Entomologist.

Luncheon—"Clifty Falls Through the Seasons." Mrs. Anna Chowning, Madison, Indiana.

Field trip emphasizing animals—Dr. W. P. Allyn, Indiana State Teachers College, Terre Haute.

Kathryn E. Coulter,
President

Fern spores can be grown successfully on agar plates, as can the spores of various types of mushrooms, toadstools and other fungi. Many of these can also be handled as bread mold usually is.

Forum on Problems of the Science Teacher*

Formal papers as follows were presented by members of the Committee: *The Laboratory Problem of the Science Teacher*, MORRIS MEISTER, High School of Science, New York; *Science in General Education*, LAURENCE L. QUILL, Michigan State University; *Recruiting and Economic Status of the Science Teacher*, RALEIGH SCHORLING, University of Michigan; and *The Necessity for Science Legislation*, K. LARK-HOROVITZ, Purdue University, Indiana. A. J. CARLSON, University of Chicago, was moderator, and he gave an excellent summary after the presentation of the papers. Also, a number of comments, which indicated a real interest in the problems, were contributed from the audience.

Conditions which contribute to the problems of teaching, including science and mathematics, relate directly or indirectly to financial conditions. These problems, specifically fitted to the areas of science and mathematics by the speakers, were revealed:

1. There is an inadequate amount and kind of laboratory procedure, due to lack of proper equipment, teachers not properly trained and steeped in laboratory technique and philosophy, and teachers overloaded with too many classes, too large classes, and too many extra-teaching duties.

2. A closer cooperation needs to exist between science and other instructional areas in the high school, to insure a well-rounded youth, and mutually to acquaint each area with the problems of the other.

3. Low salaries keep many of the best college graduates from the teaching profession. Those best trained and the most apt in science are attracted to business and industry.

4. Curriculums are not kept up to date because teachers are not paid for summer workshop and curriculum study.

5. The notion held by many young people that the teaching profession is not rated very high by the public is borne out by the fact that we now spend two and one-half times as much for liquor and three times as much for cosmetics as for education.

6. Working hours, plant conditions, and material facilities are commonly poor.

7. There is little or no guidance and supervision. Beginning teachers are left to struggle through their bewildering problems and they leave after one semester or year, in many cases. In other cases, they become so disillusioned that they take a negative attitude, aiming to "get by" without putting the extra touch so necessary for effective teaching into their work.

Obviously much, but not all, the remedy lies within the realm of finance. Dr. Schorling pointed out that increasing salary would not alone guarantee a supply of competent teachers. On the other hand, money available for better plants, equipment, training, and workshops does become an important factor toward such a guarantee. These possibilities were suggested:

1. Budgeting of funds to provide adequate laboratory facilities and to insure thorough training.

2. Approval of salary schedules which will attract the best professional people into the field. If we would decide to spend as much for schools as we spend for liquor, or one-half as much as we spend for criminals and delinquents, the following conditions would be possible:

* A Résumé of the Forum presented at the Boston Meeting of *The American Association for the Advancement of Science* by the *Cooperative Committee on Science and Mathematics Teaching*, Sunday evening, December 29, 1946. For the complete text of the papers, see *The Science Teacher*, Feb., Mar. and Apr.

a. An additional million teachers could be put into the field.
b. Incompetent, weak, and transient teachers could be screened out.
c. Attractive salaries would draw our best professional people into the field.
d. Better training could be provided.
e. Improved working conditions would be established.

3. Legislation which would provide federal aid for education in the basic sciences and mathematics. Observation of the experience of vocational agriculture, home economics and trades and industry under federal aid indicates that federal control does not necessarily follow; moreover it can be required that the state and local community match the federal contribution, thus removing the initiative from the federal to the local government.

Federal aid, in addition to helping fulfill the ideals set forth above, make possible the following:

1. Operation of methods for discovering and financing talented and deserving high school graduates for further scientific training.

2. Equalization of opportunity for adequate training for science service.

When our country begins to realize its debt to society by giving proper recognition to a service previously overlooked, we can continue to grow strong in our influence for a better world.

The Cooperative Committee on the Teaching of Science and Mathematics

The Cooperative Committee on Science Teaching was created by representatives of several scientific societies in 1941. The Committee was formed to work on educational problems which no single scientific group can solve by working alone. Chief among these problems has been that of the licensing or certification and college preparation of science teachers for high schools. The Committee published a *Preliminary Report on the Preparation of High School Science Teachers* which has been used by a number of university and college faculty committees. Another problem attacked by the Committee was that of using high school science and mathematics to meet manpower needs during the war. A report on High School Science and Mathematics in Relation to the Manpower Problem was published in 1943, and distributed to more than twelve thousand individuals.

A further function of the Cooperative Committee has been to serve as a forum in which representatives of the scientific societies have been able to state the views of their own groups and to learn the views of other groups on science teaching at the secondary and elementary levels.

The Committee has an advisory relation to its parent organizations. It reports to them regularly through their representatives.

The Committee, as organized in 1941, consisted of the following representatives of scientific societies:

American Association of Physics Teachers
K. Lark-Horovitz, Purdue University
Glen W. Warner, Wilson Junior College, Chicago
Union of Biological Societies
Oscar Riddle, Carnegie Institution, Department of Genetics
Walter F. Loehwing, State University of Iowa
Mathematical Association of America
A. A. Bennett, Brown University
Raleigh Schorling, University of Michigan
American Chemical Society
B. S. Hopkins, University of Illinois

Martin V. McGill, Lorain High School, Lorain, Ohio

National Association for Research in Science Teaching

G. P. Cahoon, The Ohio State University

Robert J. Havighurst, The University of Chicago

The financial needs of the Committee have been met by grants totaling $3000 from the Carnegie Corporation.

The original Committee served without change of personnel for three years. It was then reorganized as a Committee of the AAAS with representatives of the following societies:

American Association of Physics Teachers

K. Lark-Horovitz, Purdue University

Glen W. Warner, Chicago City College

American Astronomical Society

Oliver J. Lee, Northwestern University

American Chemical Society

B. S. Hopkins, University of Illinois

(Recently resigned and will be replaced)

American Institute of Physics

Lloyd W. Taylor, Oberlin College

American Society of Zoologists

L. V. Domm, University of Chicago

Botanical Society of America

Glenn W. Blaydes, The Ohio State University

Central Association of Science and Mathematics Teachers

Arthur O. Baker, Cleveland Board of Education

Division of Chemical Education of the American Chemical Society

Laurence L. Quill, Michigan State College

Executive Committee of the AAAS

E. C. Stakman, University of Minnesota

Geological Society of America

George A. Thiel, University of Minnesota

Mathematical Association of America

Raleigh Schorling, University of Michigan

National Association of Biology Teachers

Prevo L. Whitaker, Indiana University

National Council of Teachers of Mathematics

E. H. C. Hildebrandt, Northwestern University

National Science Teachers Association

Morris Meister, Bronx High School of Science

Chairman: K. Lark-Horovitz, Purdue University

Secretary: R. W. Lefler, Purdue University

Recently, 1945–46, the Committee prepared and distributed a report on *The Preparation of High School Science and Mathematics Teachers.* The Committee made a number of concrete proposals:

Recommendation 1. A policy of certification in closely related subjects within the broad area of the sciences and mathematics should be established and put into practice.

Recommendation 2. Approximately one-half of the prospective teacher's four-year college program should be devoted to courses in the sciences.

Recommendation 3. Certificates to teach general science at the 7th, 8th, or 9th grade level should be granted on the basis of not less than 42 semester hours of college courses in the subjects covered in general science.

Recommendation 4. Colleges and certification authorities should work toward a five-year program for the preparation of high school teachers.

Recommendation 5. Curriculum improvements in the small high school should go hand in hand with improvement in teacher preparation.

At the present time the Committee is engaged in a study of the effectiveness of science teaching at all levels, to prepare a report to be submitted to the President's Scientific Research Board.

Future plans of the committee are:

1. Licensing or certification of secondary school science teachers.

2. Training of prospective science teachers.

3. Exploratory studies of the secondary school science curriculum through workshops and conferences.

4. Assisting state or local agencies needing the services of educational consultants on questions pertaining to science teaching.

5. The Committee will report on the need for legislation leading to federal support of science teaching in the high schools. The need for scholarships on the senior high school level is as urgent as it is on the college level. The Committee will cooperate with the National Science Teachers Association and other organizations in projects for the improvement of teaching aids in science.

Membership

Although under the present plan this is not the end of the fiscal or membership year, a membership report is printed herewith, since in previous years this report has been made in the May issue. Inasmuch as we have changed our membership year to start January first, this report is not comparable to last year's. Because of the change we have some memberships expiring June 30. Since most of the memberships are paid through December 1947, most of the bills will be sent next October; for the others, bills for 75¢ for the balance of 1947 will be sent some time this month.

In the following table the 1946 column is the total membership; the 1947 column is the membership as of the time of making up this issue. Another membership report will be made at the end of the fiscal year.

	1946	1947		1946	1947		1946	1947
Alabama	20	11	Montana	11	4	Wyoming	3	1
Arizona	6	5	Nebraska	26	16	Alaska	1	0
Arkansas	6	4	Nevada	0	3	Hawaii	3	4
California	123	99	New Hampshire	14	14	Canal Zone	2	1
Colorado	21	19	New Jersey	66	53	Puerto Rico	9	4
Connecticut	41	34	New Mexico	8	3	Africa	1	0
Delaware	6	3	New York	190	161	Canada	14	15
District of Col.	28	23	North Carolina	34	25	Mexico	1	1
Florida	8	8	North Dakota	7	12	Australia	1	3
Georgia	10	9	Ohio	162	137	Belgium	0	1
Idaho	4	4	Oklahoma	15	14	British West Indies	0	1
Illinois	244	197	Oregon	42	38	China	0	2
Indiana	83	77	Pennsylvania	169	137	Cuba	0	4
Iowa	37	33	Rhode Island	9	9	Finland	0	1
Kansas	35	30	South Carolina	6	6	Holland	0	1
Kentucky	18	14	South Dakota	11	7	India	1	2
Louisiana	11	12	Tennessee	22	19	Palestine	0	1
Maine	10	10	Texas	33	26	Philippines	0	2
Maryland	43	43	Utah	9	4	South America	3	3
Massachusetts	86	94	Vermont	8	8	Sweden	1	2
Michigan	112	86	Virginia	43	30	U.S.S.R.	0	1
Minnesota	31	24	Washington	27	21			
Mississippi	11	8	West Virginia	30	35			
Missouri	47	37	Wisconsin	81	80	Totals	2102	1796

Five states show an increase in membership; Louisiana, Massachusetts, Nevada, North Dakota, and West Virginia. In as much as we had no members in Nevada in 1944, 1945 or 1946 we are especially pleased to have three there now. Eight states have the same membership as last year, all the rest have less. The states with the most new members were Illinois, Ohio, Massachusetts, New York, Pennsylvania, and Michigan.

Nine more foreign countries are on our mailing list than last year. Note especially the two in the Philippines. April 11, 1946 the secretary addressed letters to seven former Philippine members saying that we had saved *The American Biology Teacher* for them during the years of the Japanese occupation, also that we would be glad to send those magazines free if they cared to renew their membership. Two have responded. One reported that he helped delay the fall of Bataan and was with the Death March and survived the trials and privations that went with being concentrated in a Death Camp. He makes the comment that "One cannot fully appreciate the value of liberty until one is deprived of it."

Respectully submitted,

M. A. Russell,
Secretary-Treasurer

From the Editor

By the time this issue of *The American Biology Teacher* reaches the readers many of them will already have started their summer vacations. The vacations are for some teachers only periods of more intense activity, for others real opportunities for rest and relaxation. Many of them take advantage of vacations for doing the things they would be interested in doing throughout the year, provided they had time. For some, the summer is the time to write that article or take those pictures, or visit those museums and zoos. For many there will be experiences in summer camps, national parks and the like. It is our hope that many will remember *The American Biology Teacher* and share some of the activities and interests with its readers, in the form of articles and other items.

Those interested in submitting papers for appearance in the October issue should remember that manuscripts are sent to the printer about the 20th of the second month preceding that of issue. Since the editor plans to be out of Emporia most of the month of August, most of the October material will go to the printer near the end of July.

The editor wishes to take this opportunity to thank all those who helped to make the 1946–47 year one of progress for both the Association and the Journal. It takes a great deal of sincere cooperation to keep such organizations and publications going successfully. The cooperation has been forthcoming in full measure.

JOHN BREUKELMAN

LETTERS TO THE EDITOR

. . . Other teachers in preparatory school must be asked, as I am frequently, for advice in selecting a college for a student where he will receive excellent training in science. Some of these students are definitely interested in a particular branch of science, but more of them want broader experiences before they decide upon their major field of study. They all want their undergraduate work to provide a rich and sound foundation that will equip them well for work in their chosen fields or for further study. A survey, however incomplete, of American colleges and universities which are outstanding for the training they give in science as a whole, or in specialized fields, would be useful to me.

If I may make a second request, I would be very interested in articles by high school teachers who have sponsored successful biology clubs. . . .

Sincerely yours,
MISS ELIZABETH DUNLAP,
103 South Stewart Street,
Winchester, Virginia

Just received my copy of the March issue of *The American Biology Teacher.* May I congratulate you on this issue. The articles on Ecology . . . should be of interest to all who were not able to attend the Boston meeting.

Sincerely yours,
MELVIN A. HINTZ,
South Milwaukee High School,
South Milwaukee, Wisconsin

Books

LEACH, W. JAMES. *Functional Anatomy of the Mammal.* McGraw-Hill Book Co., New York. viii + 231 pp. illus. 1946. $2.50.

This manual has been designed primarily for use in laboratory courses in comparative anatomy or vertebrate anatomy where the presentation is designed to integrate a rather specific laboratory study of the cat with text material of a more general character with emphasis on man. The manual has two chief objectives. First, the intention has been to make the directions so clear that anyone using the guide will be able to find the designated structures with a minimum of outside assistance. Manual is based on actual dissections, with the specimens before the author at the time of writing. The second objective has been to emphasize the comparative im-

portance of the organs and structures that are studied. Opportunity is frequently taken therefore, to compare certain structures with those found in previously dissected animals. In addition, short paragraphs are occasionally inserted to correlate the various systems as found in several forms. This book is sufficiently illustrated and contains a useful appendix of laboratory preparation and preservation of materials. It is intended for students who are beginning work in anatomy but will be found useful in high school laboratories.

CHARLES C. HERBST,
Beverly Hills High School,
Beverly Hills, California

MOORE, ROBT. A., editor. *Ageing and Degenerative Diseases.* "Biological Symposia." Vol. XI. The Jaques Cattell Press, Lancaster, Pa. 242 pp. illus. 1945.

Advances in medical science have made possible a longer life expectancy for all of us. That this gain in years may be both profitable and enjoyable, it is necessary to study the changes which the body undergoes during the aging process. Interest in the problem of aging and the degenerative changes which seem to be a natural result of a long life are interesting to the laiety as well as to the medical profession. For that reason much of the material in the eleventh volume of Biological Symposia, "Aging and Degenerative Diseases" makes profitable reading. The contents of the book are the papers presented at a Symposium held at St. Louis in March, 1944. The participants in the discussion, all specializing in some phase of Geriatries, had no intention of considering all the anatomical, physiological and psychic changes incidental to aging. They confined their discussion to some circulatory and metabolic disorders characteristic of senescence. The major part of the book refers to the various factors involved in producing one of the most serious troubles of those of middle and advanced age—arteriosclerosis. The remaining articles on metabolic disorders are of a more general nature.

Though most of the papers are of interest to those specifically concerned with medicine, at least three chapters will be interesting and instructive to the general reader, namely, Recognition of Diseases, Treatment of Diseases, and Cancer and the Process of Aging. The rest of the volume is profitable reading if for no other reason than to learn the fact that aging is not simply the running down of the clock, but that it is due to many degenerations which might conceivably be prevented or at least delayed for many years if proper procedures of living were established in early life.

BROTHER H. CHARLES, F.S.C.
St. Mary's College
Winona, Minnesota

JAQUES, H. E. *How to Know the Trees,* rev. ed. Wm. C. Brown Co., Dubuque, Iowa. 166 pp. illus. 1946. Spiral binding $1.50, cloth $2.50.

———. *Living Things, How to Know Them,* rev. ed. 172 pp. illus. 1946. Spiral $1.50, cloth $2.50.

These two books are revisions of works so well known that a review is almost superfluous. They are members of the Pictured-Key series which now includes, in addition to the two here considered, descriptive keys to *Insects, Plant Families, Plants We Eat and Wear, Spring Flowers, Mosses,* and *Land Birds.*

The key to trees include almost all of the species of the United States and Canada east of the Rockies. Most of the descriptions are accompanied by drawings of the leaves, twigs, flowers and fruits, together with small maps showing geographic distributions. There is a separate key for the identification of the genera in winter, also a classified list of the species, with page references.

The key to living things includes phyla, classes and orders. The plant part is printed on green, and the animal part on peach-colored paper. Both parts are profusely illustrated with simple sketches bringing out the outstanding features of a typical representative of the group in question, and usually indicating the magnification. There is a phylogenetic list of the living things, with the number of species indicated for most of the phyla.

In each book there is an introductory dis-

cussion of the use of keys, also a rather extensive list of projects for class or individual study, 26 for tree study and 117 for nature study. In each case the illustrated index is extensive and well organized, so that finding specific items is relatively easy. The paper, typography, binding, size and durability are such as to make the book useful either indoors or in the field. The content is of use to all who are interested in this field and the language is within the range of average or better high school pupils. These two books, as well as the other members of the series, should be available to all who are interested in biology or nature study, either as professionals or as amateurs.

JOHN BREUKELMAN

A PINT OR QUART FRUIT JAR is a large enough aquarium for snails, Daphnia and other small crustacea, water insects and insect nymphs, leeches, and various other small aquatic forms.

NATURE GAMES is the title of an interesting little 36-page booklet that recently came to the editor's desk. It includes games using nature characters, treasure hunts, passwords, games of recognition, naming, true and false commands and cycles of nature. The games have been used for Boy Scouts, Nature Study groups of various types, also for mixed groups of all ages. The booklet may be obtained from the author, PAUL W. NESBIT, *Estes Park, Colorado*, for 75¢.

THE LYMPHATIC SYSTEM is a new chart published by Rudolf Schick. It shows all vessels, ducts and nodes in full color. It is printed on linen and is mounted on rollers. Other new charts are in preparation and will be announced in forthcoming issues. For information write Rudolf Schick Publishing Co., 700 Riverside Drive, New York 31, N. Y., or see the Schick ads in recent issues of *The American Biology Teacher*.

Preserving Specimens in Plastics

WILLIAM WEERS
President, The Castolite Company, Kenilworth, Illinois

Present conventional methods for preserving biological specimens are not always satisfactory for classroom work and permanent displays. The disadvantage of preservatives such as alcohol and formaldehyde are apparent. The inherent fragile nature of many dry mounts of insects, skeletons, flowers, plants, etc., has certain limitations for long-term preservation. Teachers in this field have recognized the need for a transparent wax or plastic to encase actual specimens so as to preserve their natural color and texture.

Commercial plastics have been used as media for embedding specimens.* The better-known casting and molding types have the shortcomings of requiring too much pressure and heat or of employing techniques which are impractical for student or classroom use.

The Castolite method has been developed to provide a simple inexpensive means of embedding many kinds of specimens for scientific as well as decorative purposes. The method is rapid, requiring no more than one-half hour for a small specimen. During this time multiple embedments may be made—in fact, it is almost as easy to preserve a dozen or more flowers as it is to make an embedment of a single specimen. The material cost for a small insect, for example, is less than 10¢ and the equipment required for the complete process need not be more elaborate than simple kitchen and workshop tools. The embedments of the flowers and ladybug in the photograph were made in a home

* See Bibliography—page 252.

workshop using equipment commonly available.

Castolite is a syrup resembling honey. It will remain liquid for a long period when stored at room temperature. When a few drops of a liquid hardener are added, a chemical reaction is initiated even at room temperature and the syrup is soon converted into a stiff jelly. When the jelly is heated to about 160° F., a hard transparent plastic is formed. The plastic will have the shape of the mold into which it was poured but it can easily be sawed, sanded and polished into the shape which exhibits the specimen most advantageously.

Let us describe exactly how the beetles in the photograph were embedded:

(1) The beetles were trapped and allowed to macerate at room temperature for one month.

(2) To 6 tablespoonfuls of Castolite were added 15 drops of hardener. The mixture was stirred until the two liquids were thoroughly mixed.

(3) Two tablespoonfuls of the catalyzed mixture were poured into a Pyrex custard cup mold. The cup was set in a pan of water heated to 150° F. In five minutes the liquid plastic started to thicken and after eight minutes the portion around the side of the dish was a soft jelly.

(4) The mold was removed from the water and the beetles were positioned in a circular pattern. The liquid near the center gradually thickened and within a few minutes the bugs were firmly engaged by the jelly-like mass.

(5) Three spoonsful of the remaining catalyzed Castolite were poured over the beetles. The bugs were firmly held and did not float. The mold was set in a pan of water at 120° F. until the second pouring was lightly jelled (about 15 minutes). The water temperature was raised to 180° F. for 30 minutes. During the last 15 minutes of heating, water was allowed to cover the plastic and dish.

(6) Upon cooling to room temperature, the piece fell from the glass dish. The softer top (exposed) surface was sanded and polished. The bottom surface required no polishing since it has the high polish of the glass surface against which it was formed.

Since water and some chemicals are harmful to the resin, it is much easier to embed dry specimens. Certain wet specimens have, however, been preserved successfully and special techniques have been worked out for embryos, flukes, jellyfish, fresh natural flowers and similar items. These exact techniques will be the subject for a later article.

The preservation of the natural colors and texture of plants and flowers is one of the most important features of Castolite. The color of flowers is unchanged in the embedment process and new methods are being developed to preserve all types of plant tissue. Chlorophyl is perfectly preserved in dried specimens and the yellow and light colors are well preserved by embedding some fresh specimens. Those items for which methods have been established are known to retain their color for long periods. A maiden hair fern embedded in 1939 is still perfectly preserved. There is every indication that there will be no change whatsoever in color and texture of materials for which the exact methods have been worked out.

It is readily apparent that embedded specimens have a definite field of usefulness as teaching aids. Specimens can be examined from all sides without working over the fumes of a preservative. Staining is possible and by a fortunate coincidence, Castolite will readily transparentize some tissue so that a study of internal structure is possible. This plastic eliminates the necessity for chang-

ing liquid preservatives and the losses due to the breakage of fragile glass containers.

The instructor or student with a scientific background, a feeling for good design and some knowledge of simple hand or power tools has a wonderful opportunity to create display specimens of true distinction.

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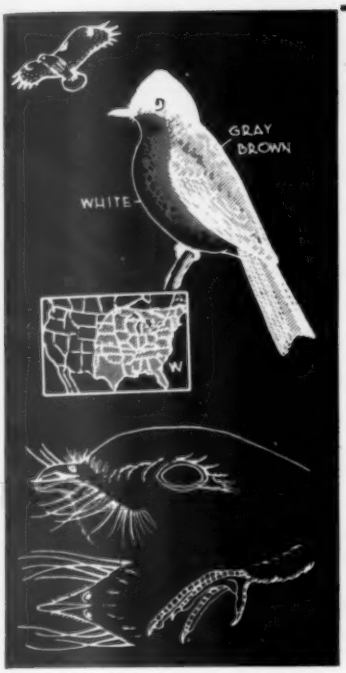

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